



E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2018; SPI: 2428-2432

Golu Uikey
Deptt. of Extension Education,
College of Agriculture,
RVSKVV, Gwalior (M.P.), India

Ravi Singh Gurjar
Deptt. of Extension Education
Dr. Bhimrao Ambedkar
University, Agra, Uttar Pradesh,
India

Mm Patel
Deptt. of Extension Education,
College of Agriculture, RVSKVV,
Gwalior (M.P.), India

Analysis of technological gap in potato production technology

Golu Uikey, Ravi Singh Gurjar and Mm Patel

Abstract

The present study was analysis of technological gap in potato production technology. The study was conducted in Morar Block, Gwalior District of Madhya Pradesh. It reported that education, extension participation, gross annual income, area under potato, economic motivation, marketing orientation, knowledge about improved practices potato cultivation, scientific orientation, cosmopolitaness, age, experience in potato cultivation and mass media participation had negative direct effect on technological gap in potato cultivation, whereas remaining material possession, land holding, socio political participation and information source utilization variables had positive direct effect and majority (55.83%) of the respondents belonged to medium overall technological gap category while about one fourth of the respondents (24.17%) belonged to low and one fifth (20%) of them belonged to high level of overall technological gap in adoption of recommended potato production technology.

Keywords: Profile of potato growers, potato production technology, Technological gap

Introduction

The all India production of potato during 2013-14 has decreased by 2.3 percent in comparison to 2012-13, as per the provisional estimates provided by the states. Madhya Pradesh is the sixth largest potato producing state accounting for 2% of total production of potato in the country. State produces 0.74 m MT of potato from an area of 108870 ha with the productivity of 21.17 t/ha.

We have different potato varieties such as Kufri Jyoti, Kufri Chipsona-1,2, Kufri Louvkar, Kufri Sinduriare cultivated by farmers; however Kufri Chandramukhi, Kufri Jyoti, Kufri LavkarKufri Sinduri Kufri Chipsona-1, Kufri Chipsona-2, Kufri Chipsona-3 varieties has been recommended for cultivation. These varieties are gaining the popularity among the farmers of the state. Therefore, potato cultivation could prove beneficial to the farmers dependent on this crop. If only the farmers take care of certain recommendations regarding technologies involved in the cultivation of potato crop. Moreover, as all of us known that development and acceptance of modern agricultural technology is the prime attention for increasing production, yet their cultivation pattern varies from farmer to farmer according to their personal, psychological and social characteristics. The new technology developed by Agricultural Universities and research institutes; it has been observed that either the same has not reached to the farmers' field or farmers are reluctant to use this technology. The technological gap is a major problem of increasing production in the country. Keeping in view the importance of knowledge and technological gap in potato production technology the following objective was undertaken; (i) To know the socio-economic, socio-psychological and extension communication attributes of the potato growers. (ii) To determine the technological gap in potato cultivation. (iii) To study the relationships between characteristics of potato growers and their technological gaps.

Materials and Methods

The study was undertaken purposively selected in Morar block, Gwalior District of Madhya Pradesh. A list of potato growing villages of selected block was obtained from department of Horticulture. Ten villages were selected randomly. Separate lists of potato cultivating farmers were prepared for each of selected village in consultation with concerned Rural Horticulture Extension Officer. Proportionate random sampling technique was followed to select appropriate sample size of 120. The primary data were collected from the respondents by using a semi-structured interview schedule, which were pre-tested before actual application and secondary data were collected from blocks and statistical offices. The technological gap was measured with the help of technological gap index developed by Biradar (2012). The formula adopted for measuring technological gap is as under.

Correspondence
Golu Uikey
Deptt. of Extension Education,
College of Agriculture,
RVSKVV, Gwalior (M.P.), India

$$\text{Technological gap index} = \frac{R-A}{R} \times 100$$

Where,

R=No. of Recommended technology,

A=No. of Practices adopted by the farmers

Multivariate path model was adopted to obtain direct and indirect effect of different characteristics of respondents on their agriculture activities and decision making process.

Path coefficient analysis was done according to the procedure suggested by Dewey and Lu (1959).

To estimate various direct and indirect effects, the following set of simultaneous equations were formed and solved

$$r_{1y} = P_{1y} + r_{12} P_{2y} + r_{13} P_{3y} + \dots + r_{1l} P_{ly}$$

$$r_{2y} = r_{2y} P_{1y} + P_{2y} + r_{23} P_{3y} + \dots + r_{2l} P_{ly}$$

$$r_{ly} = r_{1l} P_{1y} + r_{12} P_{2y} + r_{13} P_{3y} + \dots + P_{ly}$$

Where,

r_{1y} to r_{ly} = coefficient of correlation between casual factor 1 to l and dependent character y,

r_{12} to $r_{l-1,l}$ = coefficient of correlation between among factors themselves, and

P_{1y} to P_{ly} = Direct effect of characters 1 to l on character y.

Results and Discussion

Socio-personal characteristics of potato growers

The data presented in Table 1 revealed that more than half of the of the respondents (57.5%) belonged to middle age group, more than half of the respondents (51.67%) possessed middle level of education, majority of respondents (60%) had medium level of experience in potato cultivation and majority (70.83%) of the respondents had medium level of socio political participation. The major findings are related to Raghuwanshi (2014), Sharma *et al.* (2014) and Sharma *et al.* (2015).

Socio economic characteristics of the potato growers

Table 2 indicated that maximum number of the respondents (35.83%) belonged to small size of land holding. Majority of the respondents (70.83%) had medium level of area under potato, maximum number of respondents (32.5%) had gross annual income of Rs. 50,000 to 1,00, 000 and 78.5 per cent mustard growers had medium level of material possession. The major findings are related to Raghuwanshi (2014), Sharma *et al.* (2014) and Sharma *et al.* (2015).

Communication characteristics of the potato growers

The data presented in Table 3 revealed that majority of the respondents (68.33%) belonged to medium level of information source utilization, majority of the respondents (59.17%) possessed medium level of mass media participation, maximum number of respondents (45.83%) had medium level of cosmopolitaness and majority of the respondents (71.67%) had medium level of extension participation. The major findings are related to Raghuwanshi (2014), Sharma *et al.* (2014) and Sharma *et al.* (2015).

Psychological characteristics of the potato growers

A perusal of data in Table 4 indicated that majority of the respondents (57.5%) had medium level of knowledge about improved practices potato cultivation, more than half of the respondents (55.83%) had medium level of economic motivation, majority of the respondents (71.67%) had medium level of marketing orientation and majority of the respondents (68.33%) possessed medium level of scientific orientation. The major findings are related to Raghuwanshi

(2014), Sharma *et al.* (2014) and Sharma *et al.* (2015).

Practice wise technological gap in adoption of potato production technology

A perusal of data in Table 5 revealed that the practices wise average technological gap was found variation from 23 per cent to 75 per cent. The maximum gap was observed in Irrigation management (75%) followed by Insect and disease control (69%) recommended dose of fertilizers (52%), methods of weed control (49%), recommended row to row spacing and depth of sowing (47%), use of improved varieties (42%), seed treatment with fungicides (32%) and method of sowing (29%), whereas the minimum average gap was observed in seed rate (23%). The major findings are related to Patel and Vyas (2014), Singh and Yadav (2014), Sharma *et al.* (2014) and Shriwas *et al.* (2015).

Distribution of the respondents according to their technological gap in potato production technology

A perusal of data in Table 6 revealed that majority (55.83%) of the respondents belonged to medium overall technological gap category while about one fourth of the respondents (24.17%) belonged to low and one fifth (20%) of them belonged to high level of overall technological gap in adoption of recommended potato production technology. This might be due to the fact that the low level of education of potato growers, small land holding, less annual income, insufficient availability of input, less irrigation facility etc. The similar findings have reported by Singh (2007), Patel and Padheria (2010), Suman, R. S. (2010), Roy *et al.* (2013), Patel *et al.* (2014) and Patel and Vyas (2014).

Relationship between characteristics of potato growers and their technological gaps

A quantitative interpretation of direct and indirect effects of 16 socio-personal, economic, communication and psychological factors on dependent variable viz.; technological gap in potato cultivation was analyzed by Path Analysis.

The close observation of Table 7 reported that education, extension participation, gross annual income, area under potato, economic motivation, marketing orientation, knowledge about improved practices potato cultivation, scientific orientation, cosmopolitaness, age, experience in potato cultivation and mass media participation had negative direct effect on technological gap in potato cultivation, whereas remaining material possession, land holding, socio political participation and information source utilization variables had positive direct effect. The first largest positive direct effect was channelized through material possession (X_8) in case of eight factors namely, experience in potato cultivation (x_3), socio political participation (x_4), land holding (x_5), area under potato (x_6), mass media participation (x_{10}), cosmopolitaness (x_{11}), extension participation (x_{12}), and knowledge about improved practices potato cultivation (x_{13}). Whereas, land holding (x_5) channeled the first major positive direct effect through other factor for six variables namely education (x_2), material possession (x_8), information source utilization (x_9), economic motivation (x_{14}), marketing orientation (x_{15}) and scientific orientation (x_{16}), while experience in potato cultivation (x_3) and extension participation (x_{12}) channeled the positive direct effect through one variable viz. gross annual income (x_7) and age (x_1) respectively. The major finding has reported by Patel *et al.* (2014).

Constraints in adoption of recommended potato production technology

Careful examination of results presented in Table 8 revealed that major constraints expressed by potato growers were unavailability of HYV seeds (70.00%) followed by difficult to follow IPM/ IDM (69.17%), lack of technical knowledge (65.83%), lack of capital (53.33%), unavailability of organic manure (51.67%), high cost of critical inputs (49.17%), lack of storage facilities (43.33%), unavailability of seed treatment chemicals and culture (40.83%), lack of irrigation facility (39.17%), non-availability of advanced agricultural information (37.50%), high cost of agricultural implements (35%), lack of market facilities in the village (33.33%), lack of availability of farm literature in the village (30.83%), lack of proper training (29.17%) and lack of transport facilities (27.50%).

Suggestions offered by potato growers to minimize the technological gap

The results presented in Table 9 revealed the major suggestions offered by potato growers such as HYV seed should be available at the time of sowing (67.5%), need based training programmes should be conducted (65.83%), subsidy should be given on plant protection chemicals and fertilizers (58.33%), credit should be available in time (55.83%), mass production and supply of organic manure should be made (53.33%), critical inputs should be made available in time with low cost (49.17%), storage facilities should be made available at block level (45%), seed treatment chemicals and culture should be easily available (42.50%), irrigation facility should be available (40.83%) and timely availability of advanced agricultural information (37.50%).

Table 1: Distribution of the respondents according to their socio-personal characteristics (n=120)

| S. No. | Characteristics | Category | Frequency | % |
|--------|----------------------------------|---------------------------|-----------|-------|
| 1. | Age | Young (up to 35 yrs) | 14 | 11.67 |
| | | Middle (36 to 50 yrs) | 69 | 57.50 |
| | | Old (above 50 yrs) | 37 | 30.83 |
| 2. | Education | Low (< 1.23 score) | 24 | 20.00 |
| | | Medium (1.23-3.73 score) | 62 | 51.67 |
| | | High (> 3.73 score) | 34 | 28.33 |
| 3. | Experience in potato cultivation | Low (<15.64 ha) | 22 | 18.33 |
| | | Medium (15.64-38.14 ha) | 72 | 60.00 |
| | | High (> 38.14 ha) | 26 | 21.67 |
| 4. | Socio political participation | Low (< 0.67 score) | 21 | 17.50 |
| | | Medium (0.67-10.89 score) | 85 | 70.83 |
| | | High (>10.89 score) | 14 | 11.67 |

Table 2: Distribution of the respondents according to their socio-economic characteristics (n=120)

| S. No. | Characteristics | Category | Frequency | % |
|--------|---------------------|-------------------------------|-----------|-------|
| 1. | Land holding | Marginal (up to 1 ha.) | 32 | 26.67 |
| | | Small (1.01 to 2.00 ha) | 43 | 35.83 |
| | | Semi-medium (2.01 to 4.00 ha) | 38 | 31.67 |
| | | Medium (4.01 to 10.00 ha) | 04 | 3.33 |
| | | Large (>10.00 ha) | 03 | 2.50 |
| 2. | Area under potato | Low (<0.41 ha) | 30 | 17.50 |
| | | Medium (0.41-2.65 ha) | 70 | 70.83 |
| | | High(>2.65 ha) | 20 | 11.67 |
| 3. | Gross annual income | Below poverty line | 08 | 6.67 |
| | | Up to Rs. 50,000 | 16 | 13.33 |
| | | Rs. 50,000 to 1,00,000 | 39 | 32.50 |
| | | Rs.1,00,000 to 1,50,000 | 13 | 10.83 |
| | | Rs.1,50,000 to creamy layer | 25 | 20.83 |
| 4. | Material possession | Above creamy layer | 19 | 15.83 |
| | | Low (<18.14 score) | 27 | 13.50 |
| | | Medium (18.14-37.16 score) | 157 | 78.50 |
| | | High (>37.16 score) | 16 | 8.00 |

Table 3: Distribution of the respondents according to their communication characteristics (n=120)

| S. No. | Characteristics | Category | Frequency | % |
|--------|--------------------------------|---------------------------|-----------|-------|
| 1. | Information source utilization | Low (< 9.54 score) | 26 | 21.67 |
| | | Medium (9.54-18.18 score) | 82 | 68.33 |
| | | High (> 18.18 score) | 12 | 10.00 |
| 2. | Mass media participation | Low (< 2.40 score) | 21 | 17.50 |
| | | Medium (2.40-4.86 score) | 71 | 59.17 |
| | | High (> 4.86 score) | 28 | 23.33 |
| 3. | Cosmopolitaness | Low (< 6.04 score) | 27 | 22.50 |
| | | Medium (6.04-8.88 score) | 55 | 45.83 |
| | | High (> 8.88 score) | 38 | 31.67 |
| 4. | Extension participation | Low (< 9.96 score) | 18 | 15.00 |
| | | Medium (9.96-53.33 score) | 86 | 71.67 |
| | | High (> 53.33 score) | 16 | 13.33 |

Table 4: Distribution of the respondents according to their Psychological characteristics (n=120)

| S. No. | Characteristics | Category | Frequency | % |
|--------|---|----------------------------|-----------|-------|
| 1. | Knowledge about improved practices potato cultivation | Low (< 50.42 score) | 32 | 26.66 |
| | | Medium (50.42-71.16 score) | 69 | 57.50 |
| | | High (> 71.16 score) | 19 | 15.83 |
| 2. | Economic motivation | Low (< 15.74 score) | 30 | 25.00 |
| | | Medium (15.74-21.52 score) | 67 | 55.83 |
| | | High (> 21.52 score) | 23 | 19.67 |
| 3. | Marketing orientation | Low (< 11.20 score) | 20 | 16.67 |
| | | Medium (11.20-16.88 score) | 86 | 71.67 |
| | | High (> 16.88 score) | 14 | 11.66 |
| 4. | Scientific orientation | Low (< 16.46 score) | 21 | 17.50 |
| | | Medium (16.46-21.50 score) | 82 | 68.33 |
| | | High (> 21.50 score) | 17 | 14.17 |

Table 5: Practices wise technological gap in adoption of potato production technology

| S. No. | Practices | Average technological gap (%) | Rank |
|--------|--|-------------------------------|------|
| 1. | Use of improved varieties | 42 | VI |
| 2. | Seed rate | 23 | IX |
| 3. | Seed treatment with fungicides | 32 | VII |
| 4. | Method of sowing | 29 | VIII |
| 5. | Recommended row to row spacing and depth of sowing | 47 | V |
| 6. | use of recommended dose of fertilizers | 52 | III |
| 7. | Irrigation management | 75 | I |
| 8. | Methods of weed control | 49 | IV |
| 9. | Insect and disease control | 69 | II |

Table 6: Distribution of the respondents according to their technological gap in potato cultivation (n=120)

| S. No. | Technological gap | Respondents | | | |
|--------|---------------------|-------------|-------|-------|-------|
| | | Frequency | % | Mean | S.D |
| 1. | Low (less than 40%) | 29 | 24.17 | 57.33 | 22.21 |
| 2. | Medium (40-75%) | 67 | 55.83 | | |
| 3. | High (above 75%) | 24 | 20.00 | | |

Table 7: Path analysis of socio- personal, socio-economic, communication and psychological factors with technological gap

| S. No. | Factor | 'r' | Direct effect | Total indirect effect | Largest effect through other factor |
|--------|--|----------|---------------|-----------------------|-------------------------------------|
| 1 | Age (x ₁) | 0.017 | -0.044 | 0.061 | X ₁₂ (0.031) |
| 2 | Education (x ₂) | -0.409** | -0.283 | -0.126 | X ₅ (0.024) |
| 3 | Experience in potato cultivation (x ₃) | -0.116 | -0.016 | -0.100 | X ₈ (0.032) |
| 4 | Socio political participation (x ₄) | 0.039 | 0.081 | -0.042 | X ₈ (0.040) |
| 5 | Land holding (x ₅) | -0.145 | 0.107 | -0.252 | X ₈ (0.051) |
| 6 | Area under potato (x ₆) | -0.209* | -0.145 | -0.064 | X ₈ (0.058) |
| 7 | Gross annual income (x ₇) | -0.247** | -0.162 | -0.085 | X ₃ (0.039) |
| 8 | Material possession (x ₈) | 0.064 | 0.199 | -0.135 | X ₅ (0.275) |
| 9 | Information source utilization (x ₉) | -0.063 | 0.059 | -0.122 | X ₅ (0.022) |
| 10 | Mass media participation (x ₁₀) | -0.234** | -0.003 | -0.231 | X ₈ (0.040) |
| 11 | Cosmopolitaness (x ₁₁) | -0.224** | -0.051 | -0.173 | X ₈ (0.022) |
| 12 | Extension participation (x ₁₂) | -0.210* | -0.182 | -0.028 | X ₈ (0.023) |
| 13 | Knowledge about improved practices potato cultivation (x ₁₃) | -0.305** | -0.110 | -0.195 | X ₈ (0.035) |
| 14 | Economic motivation (x ₁₄) | -0.247** | -0.138 | -0.109 | X ₅ (0.021) |
| 15 | Marketing orientation (x ₁₅) | -0.257** | -0.113 | -0.144 | X ₅ (0.035) |
| 16 | Scientific orientation (x ₁₆) | -0.222** | -0.068 | -0.154 | X ₅ (0.022) |

*Significant at 0.05 level of probability, ** Significant at 0.01 level of probability

Table 8: Constraints faced by potato growers with regards to technological gap

| S. No. | Constraints | No. of respondents | % | Rank |
|--------|--|--------------------|-------|------|
| 1. | Unavailability of HYV seeds | 84 | 70.00 | I |
| 2. | Difficult to follow IPM/ IDM | 83 | 69.17 | II |
| 3. | Lack of technical knowledge | 79 | 65.83 | III |
| 4. | Lack of capital | 64 | 53.33 | IV |
| 5. | Unavailability of organic manure | 62 | 51.67 | V |
| 6. | High cost of critical inputs | 59 | 49.17 | VI |
| 7. | Lack of storage facilities | 52 | 43.33 | VII |
| 8. | Unavailability of seed treatment chemicals and culture | 49 | 40.83 | VIII |
| 9 | Lack of irrigation facility | 47 | 39.17 | IX |

| | | | | |
|----|--|----|-------|------|
| 10 | Non-availability of advanced agricultural information | 45 | 37.50 | X |
| 11 | High cost of agricultural implements | 42 | 35.00 | XI |
| 12 | Lack of market facilities in the village | 40 | 33.33 | XII |
| 13 | Lack of availability of farm literature in the village | 37 | 30.83 | XIII |
| 14 | Lack of proper training | 35 | 29.17 | XIV |
| 15 | Lack of transport facilities | 33 | 27.50 | XV |

*Data based on multiple responses

Table 9: Suggestions given by the respondents minimize the technological gap

| S. No. | Suggestions | No. of respondents | % | Rank |
|--------|---|--------------------|-------|------|
| 1. | HYV seed should be available at the time of sowing | 81 | 67.50 | I |
| 2. | Need based training programmes should be conducted | 79 | 65.83 | II |
| 3. | Subsidy should be given on plant protection chemicals and fertilizers | 70 | 58.33 | III |
| 4. | Credit should be available in time | 67 | 55.83 | IV |
| 5. | Mass production and supply of organic manure should be made | 64 | 53.33 | V |
| 6. | Critical input should made be available in time with low cost | 59 | 49.17 | VI |
| 7. | Storage facilities should be available at block level | 54 | 45.00 | VII |
| 8. | Seed treatment chemicals and culture should be easily available | 51 | 42.50 | VIII |
| 9 | Irrigation facility should be available | 49 | 40.83 | IX |
| 10 | Timely availability of advanced agricultural information | 45 | 37.50 | X |

*Data based on multiple responses.

Conclusion

Based on findings of the present study, the conclusions drawn were: (i) Maximum technological gap was observed in Irrigation management (75%); (ii) Majority (55.83%) of the respondents belonged to medium overall technological gap; (iii) Material possession, land holding, socio political participation and information source utilization variables had positive direct effect; (iv) The first largest positive direct effect was channelized through material possession in case of eight factors namely, experience in potato cultivation, socio political participation, land holding, area under potato, mass media participation, cosmopolitaness, extension participation, and knowledge about improved practices potato cultivation; (v) Major constraints expressed by potato growers were unavailability of HYV seeds (70.00%); (vi) Major suggestions offered by potato growers such as HYV seed should be available at the time of sowing (67.5%).

Acknowledgement

The authors are thankful to Dr. A.K. Singh, Vice Chancellor of RVSKVV, Gwalior (M.P.) for providing necessary facilitators to conduct the study successfully. The authors are also thankful to Dr. M.M. Patel (HOD), Department of extension education, college of agriculture, Gwalior (M.P.) for giving the valuable suggestion in improving the manuscript.

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